

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Status of Claims:

Claims 1, 6-10, 19-23 and 25 are currently being canceled.

Claims 2 and 15 are currently being amended, whereby the features of now-canceled claim 8 have been incorporated into claim 2, and the features of now-canceled claim 21 have been incorporated into claim 15.

Claims 28, 29 and 30 are currently being added.

This amendment adds, cancels and amends claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claims remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 2-5, 11-18, 24 and 26-30 are now pending in this application.

Claim Rejections:

In the Office Action, claims 1-4, 8-17, 21-27 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,079,381 to Morikawa; and claims 5-7 and 18-20 were rejected under 35 U.S.C. §103(a) as being unpatentable over Morikawa in view of U.S. Patent No. 5,522,352 to Adachi et al. These rejections are traversed with respect to the presently pending claims, for at least the reasons given below.

Presently pending independent claims 2 and 15 each recites that a controller is programmed to determine whether the operation responsiveness of the variable valve operating mechanism is lowered based on a holding energy of the actuator for holding the control shaft at a target rotational angle when a target rotational angle of the control shaft is held constant for a predetermined period of time. Since a rotational torque in the direction to make smaller the lift

and operation angle is always applied to the control shaft, a predetermined drive power (holding current) is necessitated for holding the rotational angle of the control shaft constant. Since the rotational torque is produced by a reaction of a valve spring that urges the intake valve in the direction to close, it becomes larger as the lift and operation angle become larger, thus making larger the necessary holding current. A predetermined proportional relation is thus created between the control shaft rotational angle and the holding current. If an increase in the contact resistance of the brush portion of the electric motor, partial breakage of armature, or similar deterioration is caused, larger current is required for producing the same drive torque as compared with that at the time of no deterioration. Accordingly, the proportional relation between the control shaft rotational angle and the holding current (e.g., the holding energy) at the time of deterioration differs from that at the time of no deterioration, so that the degree of deterioration of the electric motor can be detected based on the degree of difference in the proportional relation.

The above-mentioned features of amended claims 2 and 15 correspond to the features of now-canceled claims 8 and 21, respectively, whereby claims 8 and 21 were rejected under 35 U.S.C. 102(b) as being anticipated by Morikawa. However, Morikawa does not disclose anything about such features, i.e., nothing about a holding current or a holding energy.

In particular, in its rejection of claims 8 and 21 (whereby those features are now recited in presently pending claims 2 and 15, respectively), the Office Action asserts that column 4, lines 14-45 of Morikawa discloses a controller that is programmed to determine whether the operation responsiveness of a variable valve operating mechanism is lowered based on a holding energy of an actuator for holding a control shaft at a target rotational angle when a target rotational angle of the control shaft is held constant for a predetermined period of time. This assertion is incorrect. Column 4, lines 14-45 of Morikawa merely discloses steps for determining abnormality of an Engine Control Unit (ECU) employed in a valve-timing controller, whereby an execution condition for

abnormality determination is taken to be fulfilled when oil is stable with engine speed, oil viscosity is appropriate with coolant-water temperature or oil temperature, the amount of change in the target relative angle of rotation is large, and the angle of rotation deviation is large. This has nothing at all to do with a holding energy of an actuator, as recited in presently pending claim 2.

Thus, claim 2, as amended, is patentably distinct over Morikawa and Adachi et al., since Adachi et al. also does not disclose anything about a holding current or a holding energy. For the same reasons, claim 15 is patentably distinct over the cited art of record. Accordingly, all of the presently pending claims are patentable over the cited art of record.

New Claims:

New dependent claim 28 recites additional features of the present invention that are believed to provide a separate basis for patentability of this claim. New independent claims 29 and 30 have been added, whereby these claims are also believed to be patentable for the same reason as discussed above. In particular, claims 29 and 30 each recites a step of determining whether an operation responsiveness of the variable control mechanism is lowered based on the electric energy for holding actual engine performance characteristics at the target. Such features are not disclosed or suggested by the cited art of record.

Conclusion:

Applicants believe that the present application is now in condition for allowance, and an early indication of allowance is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper

payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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